IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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| Applicant: | Kobby Pick et al. | Art Unit: | 2611 |
| Serial No.: | 10/053,490 | Examiner: | Phuong M. Phu |
| Filed: | October 26, 2001 | Assignee: | Intel Corporation |
| Title: | METRIC CORRECTION FOR MULTI USER DETECTION, FOR LONG CODES DS-CDMA | | |

**Mail Stop Appeal Brief - Patents**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL BRIEF ON APPEAL

In response to the Notice of Non-Compliant Appeal Brief mailed April 11, 2007 and pursuant to the 37 C.F.R. § 41.31, M.P.E.P. § 1207.04, and the Notice of Appeal filed February 7, 2007, Applicant hereby files this Supplemental Brief on Appeal to respond to the grounds for rejection raised in the Office Action mailed November 7, 2006.

**(1) Real Party in Interest**

This case is assigned of record to Intel Corporation.

**(2) Related Appeals and Interferences**

There are no known related appeals and/or interferences.

**(3) Status of Claims**

Claims 1-28 are pending.

Claims 19-23 are allowed.

Claims 1, 3-14, 16-18, 24, 25, 27, and 28 are rejected.

Claims 2, 15, and 26 are objected to as dependent on a rejected independent claim but otherwise recognized as reciting allowable subject matter.

**(4) Status of Amendments**

In light of the Office Actions mailed April 27, 2006 and November 7, 2006 reopening prosecution, all amendments have been entered.

**(5) Summary of Claimed Subject Matter**

In direct sequence spread spectrum transmission, a stream of information is divided into small pieces, each of which is allocated across the spectrum to a different signature sequence over the same frequency channel. *See specification*, page 3, line 12-15. With multiple users, these allocations can become cross-correlated and the resulting interference is termed "multiple access interference (MAI)." *See specification*, page 3, line 20 - page 4, line 2. The amount of multiple access interference can change from symbol to symbol during a direct sequence spread spectrum transmission. *See specification*, page 4, line 1-2. However, multiple access interference is only one contributor to the total noise that afflicts direct sequence spread spectrum transmissions. *See, e.g., specification*, page 6, line 9-11.

Independent claim 1 relates to a method of normalizing an output of a receiver. *See, e.g.,* page 5, line 15-17; FIG. 2. The method includes determining a normalization factor (*see, e.g.,* page 4, line 19-24; page 6, line 6-13; FIG. 2, element 215) using a determined variance of multiple access interference (*see* page 6, lines 1-3, 9-11; page 6, line 20 - page 8, line 8; FIGS. 3 and 4) and applying the normalization factor to the output of the receiver (*see* page 6, line 14-16; FIG. 2, element 220).

Independent claim 9 relates to a receiver. *See* page 4, line 6-7; FIG. 1, element 100. The receiver includes a detector to receive transmitted information and provides [sic] one or more output symbols based on the transmitted information (*see* page 4, line 7-18; FIG. 1, elements 110, 115) a metric correction section to normalize the one or more output symbols to obtain one or more metrics (*see* page 4, line 18-19; FIG. 1, element 120), and a channel decoder to receive the one or more metrics from the metric correction section (*see* page 4, line 19-22; FIG. 1, element 125). The normalization (*see, e.g.,* page 5, line 15-17) is based on a determined variance of multiple access interference. *See* page 6, lines 1-3, 9-11; page 6, line 20 - page 8, line 8; FIGS. 3 and 4. The channel decoder utilizes the one or more metrics to decode the transmitted information. *See* page 6, line 16-19; FIG. 1, element 125.

Independent claim 24 relates to a method that includes receiving a symbol (*see* page 4, line 6-11; FIG. 1, element 110), determining a normalization factor for the symbol (*see, e.g.*, page 4, line 19-24; page 6, line 6-13; FIG. 2, element 215) using a determined variance in a level of multiple access interference for the symbol (*see* page 6, lines 1-3, 9-11; page 6, line 20 - page 8, line 8; FIGS. 3 and 4; page 6, line 6-13), normalizing the symbol with the normalization factor (*see* page 6, line 14-16; FIG. 2, element 220), and providing the normalized symbol to a channel decoder (*see* page 4, line 19-24; page 6, line 16-19).

### (6) **Grounds of Rejection**

In the action mailed November 7, 2006, claims 1, 3-14, 16-18, 24, 25, 27, and 28 were rejected under 35 U.S.C § 103(a) as obvious over U.S. Patent Publication No. 2002/0181624A1 to Gonzalez et al. (hereinafter "Gonzalez"), U.S. Patent No. 6,754,251 to Sriram et al. (hereinafter "Sriram"), and U.S. Patent No. 5,930,231 to Miller et al. (hereinafter "Miller") .

<u>As set forth in the following concise statement, the following ground for rejection is presented for review on appeal:</u>

-The rejection of independent claims 1, 9, 24 under 35 U.S.C § 103(a) as obvious over Gonzalez, Sriram, and Miller.

The other grounds for rejection are not presented for review on appeal at this time.

**(7) Argument**

The organization of the arguments presented hereinafter follows the grounds for rejection to reviewed on appeal set forth above. In particular, a separate boldfaced heading for each of ground presented for review follows.

**Since Gonzalez, Sriram, and Miller do not Disclose that the Variance of Multiple Access Interference should be Determined or Used as Claimed, the Obviousness Rejections of Claims 1, 9, and 24 should be Withdrawn**

Claim 1, which is illustrative, relates to a method of normalizing an output of a receiver. The method includes determining a normalization factor using a determined variance of multiple access interference and applying the normalization factor to the output of the receiver.

None of Gonzalez, Sriram, and Miller describes or suggests applying a normalization factor that is determined using a determined variance of multiple access interference, as recited in claim 1.

In this regard, Miller relates to the processing of telephony signals that have been transmitted along a cable TV network. *See, e.g., Miller*, col. 1, line 20-25. For transmission along the reverse path, Miller describes a reverse

path demodulator 330 that receives a broadband signal with multiple signals and separates them into individual signals for individual channels. *See, e.g., Miller*, col. 24, line 60-col. 25, line 6; FIG. 7.

Reverse path demodulator 330 includes a block receiver 360. *See, e.g., Miller*, FIG. 8. Block receiver 360 includes an analog front end 902, a digitizer 910, a QDC 915, and a channelizer 920. *See, e.g., Miller*, FIG. 9. Analog front end 902 performs various analog signal processing tasks on a broadband cable signal. *See, e.g., Miller*, col. 28, line 5-11. Digitizer 910 digitizes the broadband cable signal for down conversion at QDC 915 and channel formation at channelizer 920. *See, e.g., Miller*, col. 28, line 14-19; col. 28, line 47-49.

In Miller's embodiment, all processing after digitization is completely digital. *See, e.g., Miller*, col. 27, line 39. Such digital processing introduces a variety of error terms. *See, e.g., Miller*, col. 25, line 40-41. These digital processing error terms are caused by finite precision arithmetic, truncation, rounding of numbers which represent both the data and coefficients along the data path. *See, e.g., Miller*, col. 25, line 39-44. *Hence, these digital processing error terms are a consequence of Miller's processing of digital signals.*

Each of these digital processing error terms are modeled in Miller as having a Gaussian distribution in amplitude. *See, e.g.*, *Miller*, col. 25, line 44-47. Miller also models these digital processing error terms as not generating significant intermodulation products. *Id.* These digital processing error terms are "combined into" an equivalent Gaussian distribution whose variance is equal to the sum total variance of all of the error sources which have the same shape distribution. *See, e.g.*, *Miller*, col. 25, line 47-50.

The rejection of claim 1 is based on the contention that Miller's combining digital processing error terms into an equivalent Gaussian distribution would have made it obvious for one of ordinary skill to determine a normalization factor using a determined variance of multiple access interference. In particular, the rejection contends "it would have been obvious for one skilled in the art to determine/calculate … variance ($\sigma^2$) of noise … to be equal to the sum of variance of thermal noise and variance of cross correlation among the different PN sequences or their shifts, as taught by Miller et al, so that the variance ($\sigma^2$) of noise would be determined as required." **In other words, the rejection contends that it would have been obvious to determine a variance of noise so that the variance of noise could be determined.**

This is circular logic. As such, it is facially insufficient to maintain an obviousness rejection. By the same logic, it would be obvious to do anything so that the same thing could be done. Since 35 U.S.C. § 103(a) was clearly not intended to exclude everything from patentability, this circular logic is insufficient to maintain an obviousness rejection.

Moreover, applicant respectfully submits that combining digital processing error terms into an equivalent Gaussian distribution has nothing to do with determining a normalization factor using a determined variance of multiple access interference. As discussed above, Miller's digital processing error terms are a consequence of digital signal processing. The digital processing error terms are thus related to digital signal processing rather than multiple access interference.

Finally, in a general sense, Miller describes that these variances due to multiple error sources are to be "combined into" an equivalent Gaussian distribution whose variance is equal to the sum total variances of all of the error sources. This is comparable to the approach taken by Gonzalez and Sriram, who use generic error terms or lump the variance of multiple access interference in with other sources of noise and thus share this deficiency with Miller.

In this regard, Gonzalez uses a final channel estimate that is the linear combination of pilot-aided and data-aided channel estimates and the variances of those estimates. *See Gonzalez*, Eq. 10 and para. [0038]. This channel estimate is based on a generic variance of noise $\sigma^2$. *See Gonzalez*, para. [0031]-[0032]. Gonzalez indicates that this generic variance of noise $\sigma^2$ is to be determined using "well-known techniques." *See Gonzalez*, para. [0030]. Gonzalez is silent as to any contribution by multiple access interference to this generic noise and as to how the variance of any contribution by multiple access interference to this generic noise variance can be determined.

Further, Gonzalez describes that this generic variance of noise provides channel estimates that are both easy to generate and exhibit small variances. *See Gonzalez*, para. [0014]. The rejections have never established any basis why one of ordinary skill would depart from the easy and effective estimates described by Gonzalez and based on the generic variance of noise to determine a variance of multiple access interference, as recited in claims 1, 19, 24.

Sriram fails to remedy these deficiencies of Gonzalez and Sklar. To begin with, Sriram also does not *determine* the variance of multiple access interference. Instead, Sriram describes that the output of his code scheme is to be simulated using a total variance N. *See Sriram*, col. 17, line 44 and col.

18, line 7-18. This total variance N is similar to Gonzalez' generic variance of noise $\sigma^2$ in that it represents the contributions of a variety of different noise sources. In particular, total variance N represent contributions from "thermal noise, inter- and intra-cell interference, and cross-correlation among different PN sequences, or their shifts." *See Sriram*, col. 18, line 16-19.

Simulating a total variance does not disclose or suggest determining a variance of one contributor to that total variance. As with Gonzalez, the variance of multiple access interference is lumped in with other sources of noise. Although Miller deals with digital processing error terms, Miller too describes that multiple error terms are to be "combined into" an equivalent Gaussian distribution. There is no description or suggestion in Sriram that would lead one of ordinary skill away from including multiple access interference in with other sources to the recited determination of a variance of multiple access interference.

Since Miller, Sriram, and Gonzalez neither describe nor suggest determining of a variance of multiple access interference or even that the determination of such a variance is desirable, a *prima facie* case of obviousness has not been established. The rejections of claims 1, 19, 24, and the claims dependent therefrom should therefore be withdrawn.

Each of the dependent claims should be allowable by virtue of their dependency, as well as on their own merits.

In view of the above, it is respectfully suggested that all of the claims should be in condition for allowance. A formal notice to that effect is respectfully solicited.

Since the Notice of Appeal fee and the Brief fees have already been paid, no fee is believed due at this time. If this is in error, or charges are due for any reason, please apply such fees or charges to Deposit Account No. 06-1050.

Respectfully submitted,

Date: April 18, 2007

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## (8) Claims Appendix

1. A method of normalizing an output of a receiver, the method comprising:

determining a normalization factor using a determined variance of multiple access interference; and

applying the normalization factor to the output of the receiver.

2. The method of Claim 1, wherein applying the normalization factor comprises normalizing each symbol output from the receiver with a normalization factor that is independent of normalization factors of previous symbols.

3. The method of Claim 1, further comprising obtaining a metric correction factor using the normalization factor.

4. The method of Claim 3, further comprising providing the metric correction factor to a channel decoder.

5. The method of Claim 1, wherein determining the normalization factor comprises determining a log likelihood ratio (LLR) according to the following equation:

$$LLR(n) = -\frac{2r(n)g(n)}{\sigma_{\mathrm{T}}^{2}(n)}$$

where:

r(n) is the detector output of the $n^{th}$ symbol;

g(n) is the time varying gain associated with the desired symbol; and

$\sigma_1^2(n)$ is the total noise variance.

6. The method of Claim 5, further comprising determining the variance of multiple access interference analytically.

7. The method of Claim 5, further comprising determining the variance of multiple access interference empirically.

8. The method of Claim 1, further comprising employing multiuser detection to obtain the output of the receiver.

9. A receiver comprising:

a detector to receive transmitted information and provides one or more output symbols based on the transmitted information;

a metric correction section to normalize the one or more output symbols to obtain one or more metrics, the normalization based on a determined variance of multiple access interference; and

a channel decoder to receive the one or more metrics from the metric correction section, the channel decoder to utilize the one or more metrics to decode the transmitted information.

10. The receiver of Claim 9, wherein the detector comprises a multiuser detector.

11. The receiver of Claim 9, wherein the detector comprises a rake detector.

12. The receiver of Claim 9, wherein the metric is based on a log likelihood ratio.

13. The receiver of Claim 9, wherein the metric correction section determines one or more normalization factors to apply to the one or more output symbols of the detector.

14. The receiver of Claim 9, wherein the detector comprises a long code CDMA detector.

15. The receiver of Claim 14, wherein the metric correction section is to normalize each output symbol on a symbol by symbol basis with a normalization factor that is independent of the normalization factors of previous symbols.

16. The receiver of Claim 9, wherein the metric is based on a log likelihood ratio for BPSK signaling that is determined from the following equation:

$$LLR(n) = -\frac{2r(n)g(n)}{\sigma_{\mathrm{T}}^{2}(n)}$$

where:

r(n) is the detector output of the $n^{th}$ symbol;

g(n) is the time varying gain associated with the desired symbol; and

$\sigma_1^2(n)$ is the total noise variance.

17. The receiver of Claim 16, wherein the variance of the multiple access interference is determined analytically.

18. The receiver of Claim 16, wherein the variance of the multiple access interference is determined empirically.

19. A method comprising:

receiving one or more output symbols from a detector;

determining a normalization factor for each of the one or more output symbols, each normalization factor being independent of normalization factors for previous output symbols;

multiplying each of the one or more output symbols by the corresponding normalization factor to obtain a metric correction; and

providing the metric correction for each symbol to a channel decoder.

20. The method of Claim 19, further comprising decoding a transmission using the metric correction.

21. The method of Claim 19, further comprising determining the normalization factor based on the following equation:

$$LLR(n) = -\frac{2r(n)g(n)}{\sigma_T^2(n)}$$

where:

$r(n)$ is the detector output of the $n^{th}$ symbol;

$g(n)$ is the time varying gain associated with the desired symbol; and

$\sigma_T^2(n)$ is the total noise variance.

22. The method of Claim 21, further comprising determining a variance of a level of multiple access interference analytically.

23. The method of Claim 21, further comprising determining a variance of a level of multiple access interference empirically.

24. A method comprising:

receiving a symbol;

determining a normalization factor for the symbol using a determined variance in a level of multiple access interference for the symbol;

normalizing the symbol with the normalization factor; and

providing the normalized symbol to a channel decoder.

25. The method of claim 24, wherein determining the normalization factor comprises:

determining a time varying gain associated with a desired symbol; and

determining the variance in the level of multiple access interference for the symbol.

26. The method of claim 25, wherein determining the normalization factor further comprises determining the variance in a noise term that is independent of the variance in the level of multiple access interference.

27. The method of claim 24, wherein normalizing the symbol with the normalization factor comprises multiplying the symbol by a log likelihood ratio.

28. The method of claim 27, wherein multiplying the symbol by the log likelihood ratio comprises multiplying the symbol by

$$LLR(n) = -\frac{2r(n)g(n)}{\sigma_T^2(n)}$$

where:

r(n) is an output of the symbol;

g(n) is the time varying gain associated with the desired symbol; and

$\sigma_T^2(n)$ is the total noise variance.

## (9) Evidence Appendix

None.

## (10) Related Proceedings Appendix

None.